

2.4.3. Elevation Angle Limits

2.4.3.1. Purpose

The purpose of this test is to determine the elevation angle limits of the radar antenna and their effects upon the utility of the radar search volume.

2.4.3.2. General

As with scan angle limits, the elevation angle limits of the radar are often established by the physical limits that the antenna can be slewed up or down. These limits can be physical, caused by space or gimbal constraints within the nose cone or by interference between the radar beam and the airplane structure, although the latter is less likely for the elevation limits than for the azimuth limits. Elevation angle limits are important to air-to-ground radars since they limit the maximum pitch maneuvers the test airplane can perform and still maintain radar contact with the target. The airplane must be able to maneuver as much as possible in the terminal attack phase to defeat surface defenses while at the same time prosecuting the attack. In addition, many weapon deliveries require pitching maneuvers. Finally, the lower limit will affect the minimum range that the airplane can close on the target without losing radar contact. Most modern radar antennas have a gimbal limit of approximately 60° above and below the airplane centerline (the exact centerline used varies from airplane to airplane as with the air-to-air platforms). The limits should be measured and then the effects of these limits should be evaluated during mission relatable simulated or actual weapons deliveries, choosing the deliveries with the largest variations in pitch for the evaluation. Mission relatable evasive maneuvering (jinking) should also be performed inbound to the target.

2.4.3.3. Instrumentation

Data cards are required for this test with an optional voice recorder.

2.4.3.4. Data Required

Record the antenna elevation angle displayed on the radar display as radar video is lost in the vicinity of the cursors designating the center of the radar scan volume.

2.4.3.5. Procedure

Begin the test at a medium altitude, 15,000 feet AGL or above is typical, with enough airspeed to perform a slow pitch up to the expected theoretical elevation angle limits and to perform a recovery to level flight. Choose a target of opportunity on the nose of the airplane at least 20 nm away. Designate the target for geostable tracking using the cursor designator, if the radar is capable, narrowing the scan angle limits to a narrow selection. If the radar does not automatically select the range scale, select a scale that just includes the target. Perform a slow pitch up until the radar display disappears over the target area or until tracking breaks lock. Record the antenna elevation at the time. Re-establish target tracking and slow the test airplane. Begin a pitch over, looking for the same indications as above. Discontinue the test if any aircraft limits are reached and insure enough altitude is available for the test aircraft to perform a safe recovery from the nose-down attitude. Consult all available aircraft performance data before attempting the maneuver. Record the antenna elevation as above. During mission relatable attacks, record the effects the above antenna elevation limits have upon ingress and weapon delivery tactics.

2.4.3.6. Data Analysis and Presentation

Use the displayed antenna elevation at the time that radar detection is lost on the target of opportunity as the elevation limits. Relate the elevation limits to the restrictions that they place upon jinking and upon delivery tactics while maintaining target radar detection.

2.4.3.7. Data Cards

A sample data card is presented as card 26.

CARD NUMBER ____ TIME ____ PRIORITY L/M/H

AIR-TO-GROUND ELEVATION ANGLE LIMITS

[CLIMB TO _____ FEET AGL, INCREASE SPEED TO ____ KIAS AND CHOOSE A TARGET OF OPPORTUNITY ON THE NOSE AT 20 NM. DESIGNATE THE TARGET USING GEOSTABLE CURSORS AND NARROW THE DISPLAY. SELECT THE SHORTEST POSSIBLE RANGE SCALE WHICH STILL DISPLAYS THE TARGET. PITCH UP UNTIL THE TARGET IS NOT DETECTED AND RECORD THE ANTENNA ANGLE. SLOW TO ____ KIAS AND REPEAT IN A PUSH OVER.]

LOWER LIMIT	UPPER LIMIT

[QUALITATIVELY EVALUATE THE EFFECTS OF THE ELEVATION LIMITS UPON INGRESS TACTICS AND WEAPON DELIVERIES.]

TACTIC OR DELIVERY _____

MANEUVER _____

EFFECTS: